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(19)

(54) ILLUMINATING PANEL FOR INSTRUMENT CONSOLES

(71) We, THORN ELECTRICAL INDUSTRIES LIMITED, a British Company, of Thorn House, Upper Saint Martin's Lane, London, WC2H 9ED, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The present invention relates to improvements in illuminating panels, inter alia for instrument consoles, and more particularly to illuminating panels provided with encapsulated lamps.

Illuminating panels or "overlays" were originally developed for use in aircraft cockpits to enable instrument dials and legends, the latter serving for example to identify switches and warning lights, to be read clearly by day and night. Such overlays were secured or clipped to the faces of existing instrument panels. The original panels were provided with miniature lamps which were plugged into the back surfaces of the panels and wired together conventionally. The main drawback with such a panel is that it must be removed from the instrument console each time it is necessary to replace a lamp. A later, improved panel incorporated sockets built into the back of the panel, the lamps being accessible from the front for replacement.

The fitting and wiring together of lamp sockets is time-consuming and costly, and such panels are not readily manufactured on a large scale, for example on automatic machinery. Subsequently, overlay panels were made in two parts to facilitate manufacture. One part comprised the visible overlay, and the other consisted of a semi-rigid printed circuit board bearing lamps. The two parts are fastened together mechanically, for example by rivetting, upon completion of manufacture. It has been found very expensive to manufacture these panels, both as regards tooling and labour time. Also, the printed circuit board assemblies are quite fragile and easily broken. Their most vulnerable features are their lamps, which can easily be partially or wholly detached from the printed circuit boards. It has been found that these panels are prone to damage, not only in handling, but also in service. Mechanical vibration to which these panels are commonly subjected has been found to give rise to resonance of the printed circuit boards and consequent failure of the circuits and/or the lamps.

According to the present invention, there is provided an illuminating panel for instrument consoles comprising a light-transmitting core with openings for instrument dials and control devices, an opaque layer on one face of the core, the opaque layer having perforations forming legends, a plurality of lamps within the core for back-illumination of the legends, and a printed circuit adjacent the other face of the core, the printed circuit interconnecting the lamps with an input terminal characterised in that the panel is an integral multi-layer composite with the printed circuit formed directly on the said other face of the core acting as a substrate. Preferably, the lamps are accommodated in pockets in the core and are embedded therein in a light-transmitting potting compound. The potting compound is desirably of a resilient elastomeric nature, to protect the lamps from the effects of vibration occurring in service. Each lamp may be connected to the printed circuit in the usual way by soldering. With such a construction, it is not possible to remove a given, defective lamp and replace it with a new one. Alternatively, the core can be provided with miniature sockets connected to the printed circuit, the lamps being removably held in the sockets.

The opaque layer is preferably a dark colour e.g. grey, and whilst the core is preferably a transparent plastics sheet, it could be opalescent to act as a diffuser. In such a case, the legend symbols would appear in daylight as white markings against the surrounding dark background of the opaque layer.

In a preferred embodiment, however, the core is transparent sheet, for instance an acrylic plastics material. Interposed between the core and the opaque layer is a diffusing layer or screen. From certain areas of the core surface, the opaque and diffusing layers may be omitted, so as to provide clear windows rendering instrument dials on the console visible. The transparent core can not only provide back-lighting of the legends, but also side-lighting of the dials.

To manufacture a panel embodying the invention, the core is first preformed by machining or moulding. The printed circuit can be applied thereto by conventional techniques such as galvanic plating or silk screen printing. Thereafter, an insulating covering layer is desirably applied over the printed circuit for protection against damage and possible shorting out in use. The provision of legend perforations can be accomplished after application of the opaque layer by engraving or by an etching process using photo-resist techniques.

Advantageously, numerous panels embodying the invention are manufactured from a single core sheet, the individual panels being separated from one another at the conclusion of the manufacturing sequence.

The present invention will now be described by way of example with reference to the drawings accompanying the provisional specification, in which:—

Fig. 1 is a plan view of the rear face of an illuminating panel or overlay, and

Fig. 2 is a perspective view of the panel seen from the front, the panel being shown partly cut away.

The illustrated panel or overlay 10 has a particular shape enabling it to fit over the face of a given instrument console, not shown. The actual design will differ from panel to panel as required by the consoles to which the different panels are to fit. In this instance, panel 10 includes an opening 11 to accommodate an instrument dial, and two openings 12 and 13 for accommodating a selector switch knob and shaft, and an on-off switch respectively. The panel 10 is arranged to provide back-illumination of legends 15, and side-lighting of the instrument dial and the bezel of a selector switch knob accommodated in the openings 11 and 12 when the panel 10 is in use. Side-lighting of these components is via the boundary walls 16 of the openings 11 and 12.

The panel 10 is of a sandwich construction having a plurality of discrete layers which are bonded together to form a unitary whole. The main, thickest layer 18 forms a core consisting of a transparent sheet, for example a transparent plastics material such as Perspex (Registered Trade Mark) acrylic sheet. The core 18 is preshaped with openings 11, and 12 13, according to the design of the instrument console, and incorporates lighting means located within its body.

The lighting means comprise a plurality of miniature baseless lamps 19. The lamps 19 are accommodated wholly within the body of the core 18, in recesses or pockets 20 therein. As shown, the pockets 20 are of similar oval shape as the lamps 19. Each lamp 19 is securely held in its pocket 20 by a mass of transparent potting compound, not identified in the drawings for simplicity. The potting compound can be resilient elastomer in order to protect the lamps 19 from mechanical shocks.

The lamps 19 are connected electrically to one another by means of a printed circuit pattern 21 which is applied directly to the rear face of the core 18. The printed circuit pattern 21 also connects with a two-pole input terminal 22 secured to the core 18, the input terminal 22 projecting from the rear face of the panel 10. It will be understood that the face of the instrument console will be provided with a mating socket to enable electrical power to be supplied to the lamps 19 via the terminal 22 and printed circuit pattern 21. The lead wires of each lamp 19 are connected to the printed circuit pattern 21 by soldering, as at 24.

A protective layer 25 is applied to the rear face of the core 18, thereby sandwiching the printed circuit pattern 21 between the core 18 and the layer 25. As shown, the protective layer 25 has oval apertures 26 which coincide with the pockets 20, the apertures 26 being somewhat larger than the pockets. The apertures 26 make removal and replacement of the lamps 19 possible. Whilst protective layer 25 would normally be permanently bonded to the core 18, it could be adhered removably thereto.

The front face 28 of the core 18 has a facing 29 incorporating two discrete layers, the inner of which is in direct contact with the core 18. The inner layer constitutes a white diffusing screen and is applied over the whole of the surface of the core 18 with the exception of an area 30 in register with the opening 11, an area 31 surrounding the opening 12 and the area of the opening 13. The outer layer, which forms the front surface of the panel 10, is an opaque, darkly-coloured coating which covers the same regions as the inner layer. The opaque coating is perforated to form printed and other symbols and markings, collectively termed legends 15 herein. In daylight, the legends 15 appear as white markings on the darkly-coloured face of the panel 10, the legends being white by virtue of the underlying diffusing screen layer. At night,

when the lights of the panel 10 are illuminated, the legends 15 glow white in an effectively glare-free manner.

If desired, the facing 29 can include a thin substrate of transparent material to which the diffusing and opaque layers are applied. The substrate is preferably of the same material as the core 18 to which it is bonded and can form a window over each of the areas 30 and 31.

Manufacture of the panel 10 can be accomplished in the following way. The core 18 is preshaped with the required openings 11, 12 and 13 and pockets 20, either by machining or moulding. It is convenient to produce a plurality of cores 18 and panels 10 from a single large acrylic sheet. Separation into individual cores 18 or panels 10 can be effected during the course of manufacture or at the end of the manufacturing process. For convenience, the manufacture of panels individually will be described, it being understood that the description applies equally to the production of a multiplicity of panels 10 from a single acrylic core sheet.

Having preshaped the core 18, the printed circuit pattern 21 is applied to one face thereof as a copper deposit. The pattern 21 is applied for example by galvanic plating or silk screen printing using conducting inks, using known techniques. The lamps 19 are then soldered to the pattern 21 and potted or encapsulated with an appropriate transparent high temperature compound. The terminal 22 is then soldered to the pattern 21 and thereafter, the insulating protective layer 25 is secured to the core 18. The layer 25 can be a thin acrylic sheet which is bonded to the core 18, self-adhesive polyvinylchloride sheeting or a spray-applied rubber base layer.

The diffuse and opaque layers forming the facing 29 are applied to the opposite surface of the core 18, either before or after the circuit pattern 21 is applied. The diffuse layer can be paper, although a white plastics material is preferred. The diffuse layer can be applied by spraying, rolling, or "floating" onto the core 18. The opaque outer layer is applied in a similar manner onto the previously deposited diffuse layer. Having applied the opaque layer the legends 15 are formed. This can be accomplished by engraving, for example manually, or by an etching technique using photo-resist methods which are known in themselves. As stated earlier, the diffuse and opaque layers can be applied to a separate transparent sheet instead of directly to the core. This is preferred particularly when the panel 10 is to include clear windows over the areas 30, 31.

The present method is well adapted to mass production and yields panels 10 which are superior to earlier panels. The hitherto potentially weak circuit patterns are rendered effectively unbreakable through mishandling since the patterns are integral with the panels. In service, damage to the circuit itself as well as to the lamps as a result of vibration is substantially eliminated. This is because the relatively thick panel 10 is much less prone to resonance than the thin, semi-rigid circuit boards hitherto employed.

Whilst potted or encapsulated, permanently fitted lamps 19 are preferred for mechanical reasons, the panel 10 could incorporate miniature lamp-accommodating sockets. The lamps 19 could be inserted into the sockets and removed therefrom from the front or the rear of the panel, as has been done in the past.

Illuminating panels embodying the invention are suitable for use in aircraft, theatre lighting control units and the like. Such panels could also be used as flow indicators for process control equipment and for station finders in radio tuners. Other applications will be readily apparent.

WHAT WE CLAIM IS:—

1. An illuminating panel for instrument consoles comprising a light-transmitting core with openings for instrument dials and control devices, an opaque layer on one face of the core, the opaque layer having perforations forming legends, a plurality of lamps within the core for back-illumination of the legends, and a printed circuit adjacent the other face of the core, the printed circuit interconnecting the lamps with an input terminal characterised in that the panel is an integral multi-layer composite with the printed circuit formed directly on the said other face of the core acting as a substrate.

2. An illuminating panel as claimed in claim 1 characterised in that the lamps are embedded in a light-transmitting potting compound filling pockets in the core.

3. An illuminating panel as claimed in claim 2 characterised in that the potting compound is a resilient elastomer.

4. An illuminating panel as claimed in claim 1 wherein the lamps are held in sockets connected to the printed circuit characterised by a layer of electrically insulating material covering the printed circuit and having openings in register with the pockets containing the lamps.

5. An illuminating panel for instrument consoles substantially as described with reference to the drawings accompanying the provisional specification.

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1445840 PROVISIONAL SPECIFICATION
1 SHEET *This drawing is a reproduction of the Original on a reduced scale*

FIG. 1

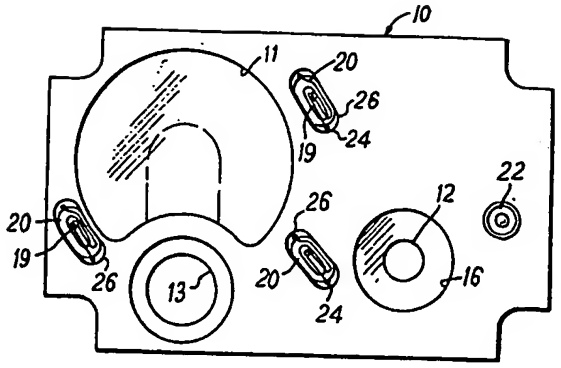

FIG. 2